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IN SEARCH OF THE BEST TEST FOR  
HIP LABRUM ASSESSMENT.  
A SYSTEMATIC LITERATURE REVIEW

Degree Programme in Physiotherapy  
2016

# IN SEARCH OF THE BEST TEST FOR HIP LABRUM ASSESSMENT. A SYSTEMATIC LITERATURE REVIEW

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Degree Programme in Physiotherapy

May, 2016

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Number of pages: 22

Keywords: groin pain, impingement test, hip labrum pain, ice hockey

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The purpose of this thesis is to gather information about the current tests used to assess hip labrum pain. The research question asks what is the best testing method to assess hip labrum pain when looking at hockey players groin pain. The thesis is intended to help people working with ice hockey players.

This thesis is in the form of a systematic literature review. A search was done in three search databases; Pubmed, Ebsco, and Science Direct. The search resulted in the selection of 6 articles meeting the set search criteria. After a close review of the testing methods 3 more were excluded. Finally 3 were selected due to the fact they all shared the same testing method with the focus of sensitivity and specificity of the tests giving a better value on the reliability of the tests.

The result of the review was that the impingement test, flexion internal rotation abduction, had the highest level of sensitivity and specificity making it the best for assessing hip labrum pain.

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## 1. INTRODUCTION

Ice skating is different from walking or running. It puts much more stress on the hip joint. To achieve forward propulsion when ice skating, one must push the skate to the side not back because of the low friction between the ice and the skate. The motion consists of repetitive abduction extension and adduction flexion of the hip joint. When decelerating a repetitive eccentric contraction of adductor muscles of the leg are used. (Bracko 2004b, 52; Chang, Turcotte & Pearsall 2009b)

Poor assessment of an injury, which can continue into an inadequate recovery plan, can be a major reason for an early end of a sports career. Groin injuries make up 2 to 5% of all sport injuries, with a recurrence rate of up to 15 to 31%. Therefore the ability to assess players injuries accurately is paramount but very challenging. (Shetty, Shetty, & Shetty 2015b)

The purpose of this thesis was to gather information about the current tests being used to determine the cause of hip labrum pain. A systematic review a search was done to find relevant articles using Pubmed, Ebsco, and Science Direct. The goal was to find the best test that can be used by people who work with ice hockey players.

## 2. ANATOMY

### 2.1. Pelvic girdle and hip joint

The hip and groin is made up of pelvic girdle, femur, muscles, ligaments, labrum, nerves, blood vessels and other tissues. The pelvic girdle is made up of two hip bones and sacrum joined together by three joints. The hip bones consists of Ilium, pubis, and ischium. The sacrum, which is located posteriorly, is made of five fused vertebrae. The sacrum is situated between the two ilium bones and joined together at the sacroiliac joints. Anteriorly the two pubis bones connect at the third joint via the pubic symphysis. (Tortora & Derrickson 2009b, 245-250)

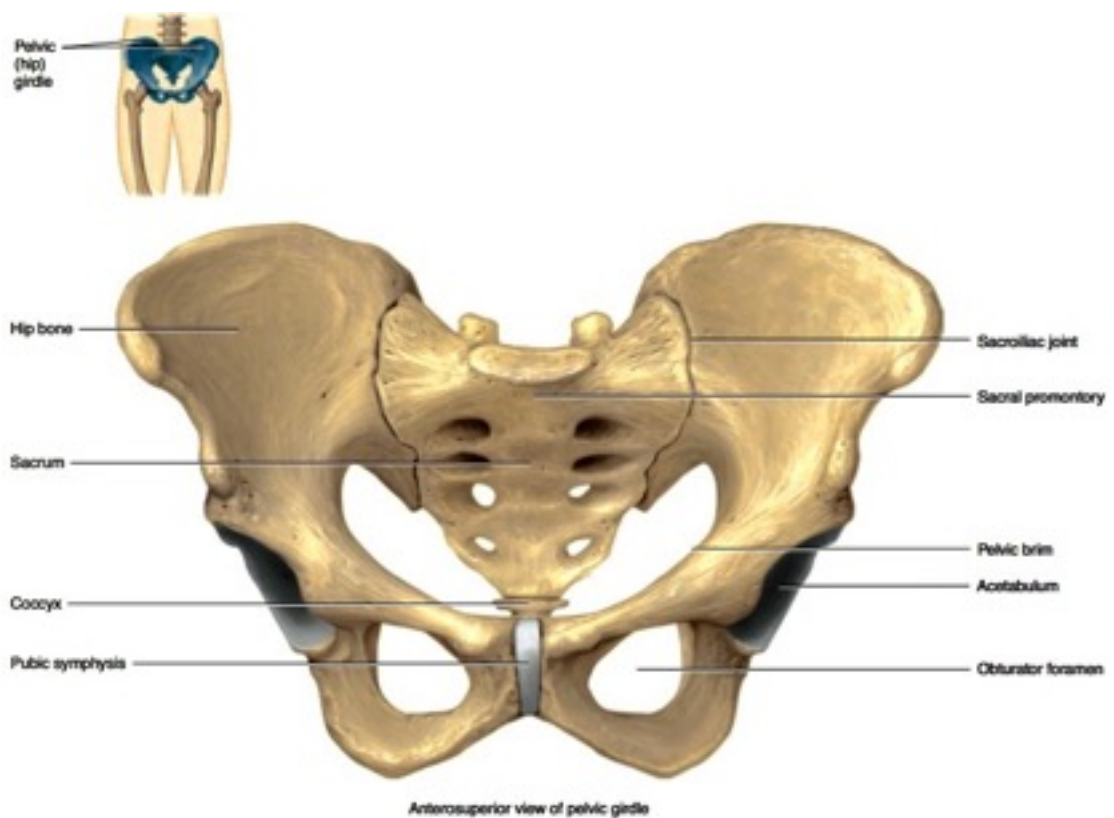


Figure 1. Pelvic girdle

(Tortora & Derrickson 2009b, 245)

The hip joint is a ball and socket joint made up of the head of femur and acetabulum of the pelvic bone. Components of the joint include auricular capsule, iliofemoral ligament, pubofemoral ligament, ischiofemoral ligament, ligament of the head of the femur, acetabular labrum, and transverse ligament of the acetabulum. (Tortora & Derrickson 2009b, 288)

The acetabular labrum is a fibrocartilage which is attached to the edge of the acetabulum to increase the depth of the socket. Acetabular labrum is smaller in diameter than the head of the femur so dislocation is a rare occurrence. (Tortora & Derrickson 2009b, 288)

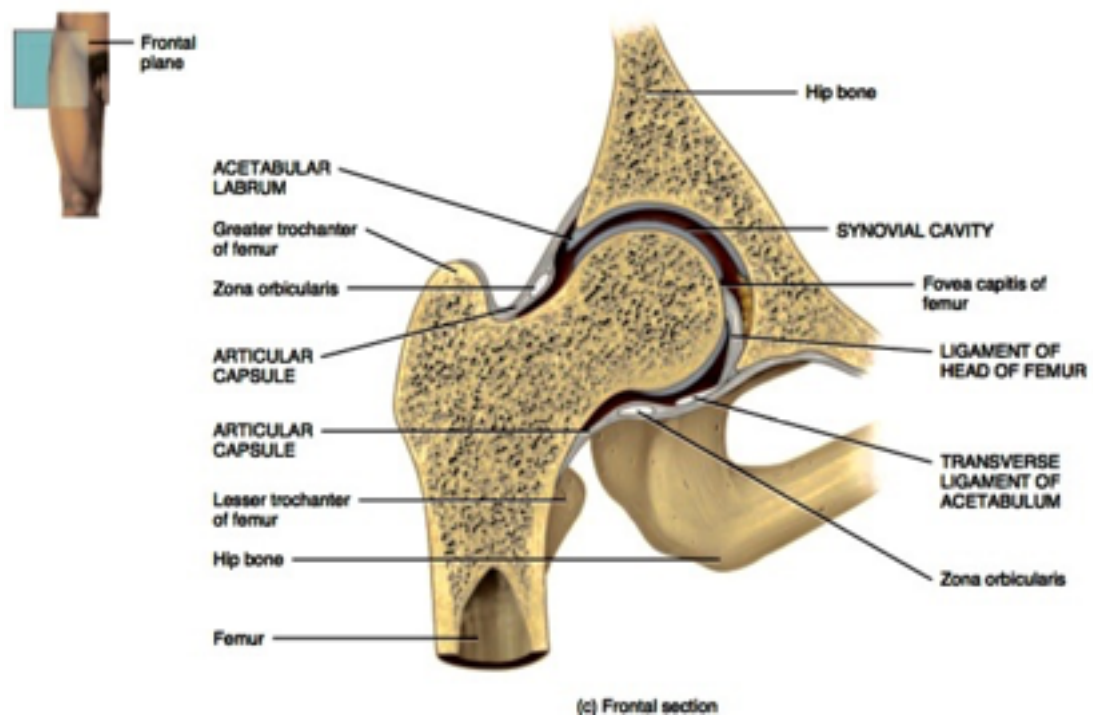


Figure 2. Frontal plane of the hip joint.  
(Tortora & Derrickson 2009b, 289)

## 2.2. Anatomy of the inguinal region, groin muscle insertions

The muscles of the groin area include adductor brevis, adductor longus, adductor magnus, gracilis, pectineus and psoas. Adductor brevis originates on inferior ramus of pubis and insert on the superior half of linea aspera of femur. Adductor longus originates on pubic crest and pubic symphysis and insert on linea aspera of femur. Adductor magnus originates on inferior ramus of the pubis and ischium to ischial tuberosity and inserts on linea aspera of femur. Gracilis origin on the body of inferior ramus of pubis and inserts on medial surface of the body of tibia. Pectineus originates on inferior ramus of pubis and insert on the superior half of the linea aspera of femur. Psoas originates on the transverse processes and bodies of lumbar vertebrae and inserts on the lesser trochanter of femur. All of these muscles work together to adduct the leg. (Tortora & Derrickson 2009b, 394; 400)

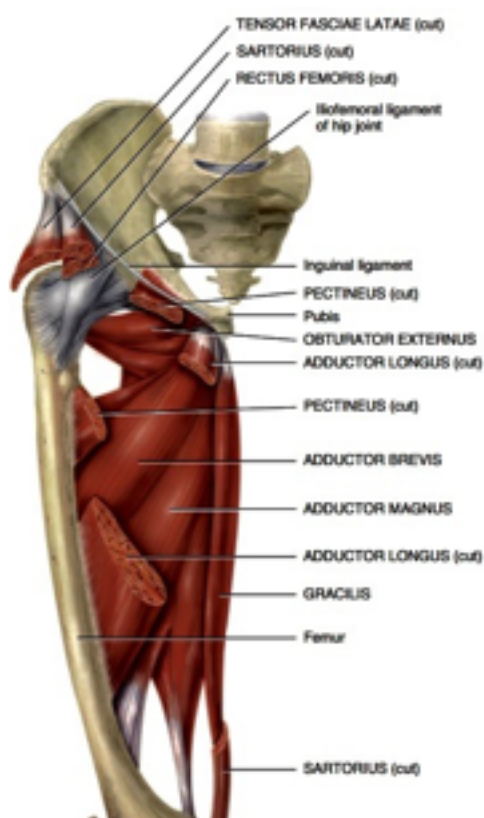


Figure 3. Adductor muscles of the leg  
(Tortora & Derrickson 2009b, 396)

### 3. PHYSICAL DEMANDS OF ICE HOCKEY

Ice hockey has two teams with 22 players and the game consists of 3 periods of 20 minutes with a possibility of overtime and a shoot out. There are 12 players on the ice at one time with high speeds, quick directional changes, and full body contact allowed. (Tuominen, Stuart, Aubry, Kannus & Parkkari 2014b) Ice skating skills are one of the most important parts of ice hockey. A low number of research has been dedicated to the study of biomechanics of this action. The reason for this has been attributed to the challenge of gathering data because of the on-ice aspect of the game. The skill of ice skating is one of the main factor seen in comparing professional and recreational players. (Buckeridge, LeVangie, Stetter, Nigg & Nigg 2015b.) Other aspects of ice hockey include demanding physical contact bouts for ice position, puck control, hand and arm strength for stick control. (Bracko 2004b, 47-52; Jaime, Burr, Baker, Macpherson, Gledhill & McGuire 2008b, 1535)

Characteristics involved in ice skating include two-foot forward glide with skates positioned wider than the shoulders. The feet are dorsiflexed and the hips and knees are flexed. Propulsion requires the skates one at a time to be pushed to the side because of the low friction of the blade of the skate and the ice. To achieve each stride it requires force extension, external rotation, and abduction of the leg followed by the recover phase of anterior hip flexion, adduction and internal rotation. The upper body leans forward. Hip flexion degree angle depends on skating speed. The shoulders sway from side to side with a smooth movement pattern in rhythm with the hips. (Bracko 2004b, 47-52)

Ice hockey players are susceptible to adductor muscle strains. These injuries are prevalent due to muscle weakness and preexisting injuries. (Tyler, Silvers, Gerhard & Nicholas 2010b)



#### 4. COMMON GROIN INJURIES

From 2006 to 2013 the men's International Ice Hockey Federation World Championship tournaments and Olympic Winter Games were analyzed for incidence, type, mechanism and severity of injuries. This was a 7 year study that revealed 528 injuries plus an additional 27 coming from practice. A relatively high injury rating, 60.7% of the injuries sustained, came from body checking, sticks and pucks. Common injuries came in the form of laceration, sprains, contusions, and fractures. (Tuominen, Stuart, Aubry, Kannus & Parkkari 2014b)

Another study was conducted looking at asymptomatic 21 professional and 18 collegiate hockey players to determine the prevalence of pelvic and hip labrum tears. Results revealed 36% had adductor abdominal rectus dysfunction, and 64% hip pathologic changes. Overall the study showed that 77% of the players had hip and groin pathologic abnormalities. (Silvis, Mosher, Smetana, Chinchilli, Flemming, Walker & Black 2011b) Furthermore of the 21 professional hockey players a four year follow up study was done. The study revealed hip labral tears in 20% of the players within the first two years of the study. (Gallo, Silvis, Smetana, Mosher, Stuck, Lynch, & Black, 2013b)

## 5. SYSTEMATIC LITERATURE REVIEW

### 5.1. What is a systematic literature review?

A systematic literature review is a process of gathering published articles on a particular subject and summarizing them with a strict unbiased analysis. “Systematic” is given when it has a clear question, selection of relevant articles, reviews the quality, sets criteria for inclusion and exclusion, and summarized the results. (Khan, Kunz, Kleijnen & Antes 2003b, 118-121; Cronin, Ryan & Coughlan 2008b, 3-4; Ryan 2010b, 1-2)

### 5.2. Five Steps

To undertake a systematic review there is a five step process one can follow. Those five steps include: question development, relevant articles search, quality articles, results, and conclusion. (Khan, Kunz, Kleijnen & Antes 2003b, 118-121; Ryan 2010b, 3-6)

Step 1. Question development should be the first thing to start the thesis process. When posing the question it should be clear having only one meaning and not open to interpretation. One option when developing the question is to use Campbell Collaboration SAMPLE frame work; Is the question specific, answerable, measurable, practical and empirical? (Khan, Kunz, Kleijnen & Antes 2003b, 118-119; Ryan 2010b, 3; Cronin, Ryan & Coughlan 2008b, 7-8)

Step 2. The search for relevant articles should not have much restriction. It is important to expand the search as wide as possible including multiple sources. In this day and age most searches can be conducted via the internet though many medical and school databases may require authorization to access the full text. It is also important to document this process with time frame and search methods as it will be pre-

sented in the results of the review. (Khan, Kunz, Kleijnen & Antes 2003b, 118-120; Gwen Ryan 2010b, 4-5; Cronin, Ryan & Coughlan 2008b, 8-12)

Step 3. Articles inclusion and exclusion can be firstly filtered in search database in the advanced search option. Quality evaluation may be conducted by the database them selves. Most publication also have a summary with the title and author of the articles. The critical appraisal skills programme (CASP) within the public health resource unit has several checklists. Physiotherapy Evidence Database ([pedro.org.au](http://pedro.org.au)) for example uses the PEDro scale to evaluate quality. These selections can help to quickly and easily assess if the article should be include for preview. A preview of the the article should include reading the abstract or purpose to help decided if full text should be read and be then include or exclude from the review. (Khan, Kunz, Kleijnen & Antes 2003b, 118, 120-121; Ryan 2010, 5; Cronin, Ryan & Coughlan 2008b, 12-14; Website of the Physiotherapy evidence database 2016)

Step 4. Results of the studies are joined together using methods of tabulation of characteristics, quality, effects and differences in the studies. (Khan, Kunz, Kleijnen & Antes 2003b, 118,121; Ryan 2010b, 6; Cronin, Ryan & Coughlan 2008b, 14-16)

Step 5. Conclusion is the outcome of all the steps with a record of the process which is examined and the results made. It is also important to develop an unbiased conclusion. (Khan, Kunz, Kleijnen & Antes 2003b, 118, 121; Ryan 2010b, 6; Cronin, Ryan & Coughlan 2008b, 15-16)

## 6. RESEARCH PURPOSE

The purpose of this thesis is to conduct a systematic literature review answering the question: What is the best testing method to assess hip labrum pain when looking at hockey players groin pain.

## 7. RESULTS

### 7.1. Search strategy

A search was done 19-20.4.2016 using search database of Pubmed, Ebsco, and Science Direct open access. A combination of search teams where used to retrieve relevant studies. Hip labrum, pain, tear, lesion, and testing with a publish date restriction of 2000 - 2016.

Entry terms		PubMed	Ebsco	Science Direct Open access
Hip Labrum				
	AND Pain	194	46	24
	AND Tear	200	65	14
	AND Lesion	40	15	36
	AND Testing	15	8	24
Total		449	134	98

Table 1. Entry terms

## 7.2. Study selection

The results of the 3 databases search was 681 articles. The Table 2 shows the process of study selection. Of the 681 articles remaining an exclusion criteria was done. the criteria included exclusion of non English publication -22, non human centered -73, non available in full text -125, and lastly duplicates -23. This resulted in 438 articles which were then selected by topic title leaving 61 and finally an abstract preview. The resulting number being 6 which were selected to be included in this literature review. On closer review of the testing methods 3 more articles were excluded.

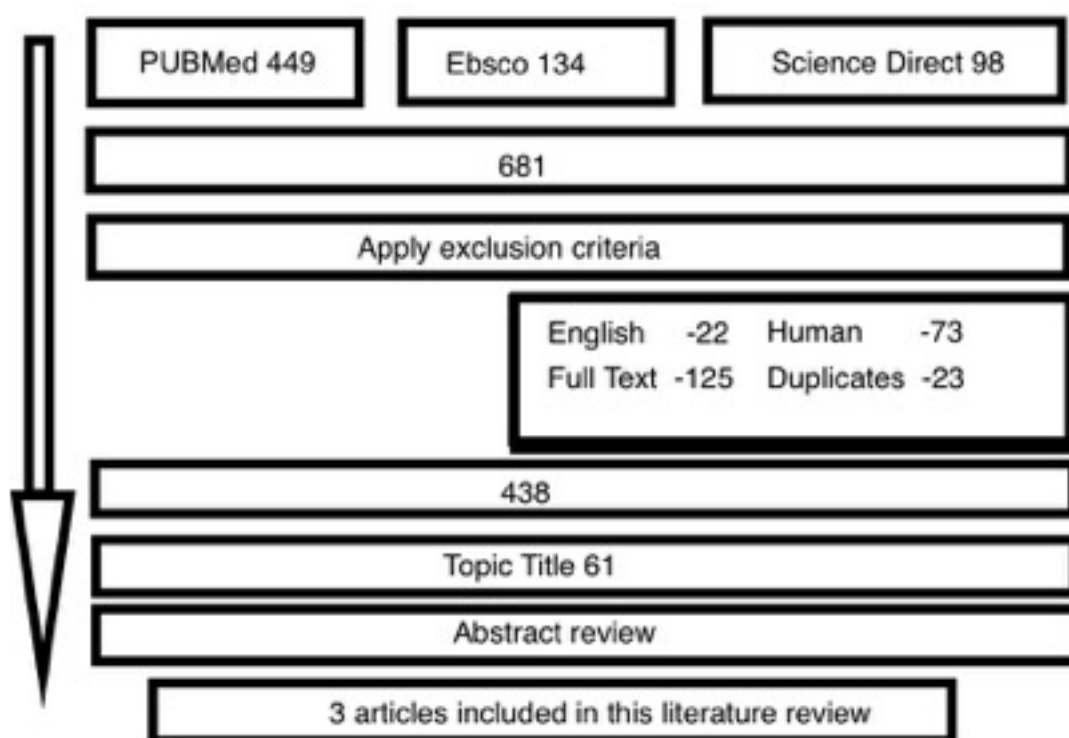


Table 2. Flow chart of study selection

Title, Author & Publication	Purpose	Design	Participants	Results	Relevance to study question
The Diagnostic validity of hip provocation maneuvers to detect intra-articular hip pathology. Maslowski et al 2010	<p>To determine the best maneuvers of hip provocation</p> <p>50 subjects</p> <p>4 tests used</p> <p>Design was a prospective diagnostic study.</p>	Prospective diagnostic study	50 participants	<p>tests: FABER with sensitivity of <math>21/26 = 0.82</math> and a specificity of <math>6/24 = 0.25</math>. Stinchfield with sensitive of <math>15/26 = 0.58</math> and specificity of <math>7/24 = 0.29</math>. Scour with sensitivity of <math>16/26 = 0.62</math> and specificity of <math>9/24 = 0.38</math>. IROP with sensitivity of <math>23/26 = 0.88</math> and specificity of <math>4/24 = 0.17</math>.</p>	<p>Sensitive tests: flexion abduction external rotation test and internal rotation over pressure (IROP)</p> <p>The most specific test was Stinchfield maneuver</p> <p>FABER and IROP had the highest positive predictive</p> <p>IROP had the highest negative predictive value.</p>

What is the role of clinical test and ultrasound in acetabular labral tear diagnostics? Troelsen et al 2009	diagnostic validity of clinical tests was investigated to determine sensitivity and specificity and ultrasound as compared with MR arthrography.	18 Participants	MR identified 17/18 labral tears  Ultrasound had a sensitivity 94%  positive predictive value 94%  The impingement test had the best diagnostic ability of the clinical tests,  positive predictive value was 100%	The impingement test had the best diagnostic ability of the clinical tests
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Anterior impingement test for labral lesions has high positive predictive value. Hananouchi et al 2012	<p>investigated impingement tests for labral lesion in two groups with these four parameters</p> <p>(1) in unselected patients with hip pain, and</p> <p>(2) in three subgroups of patients with dysplasia, femoroacetabular impingement (FAI), and with an intact joint space.</p>	Diagnostic study	69 Participants	<p>The four parameters in all hips were 50.6% (45/89), 88.9% (16/18), 95.7% (45/47), and 26.7% (16/60).</p> <p>All three parameters were similar in all.</p>	<p>The study resulted an average of sensitivity low 50.6%, specificity 88.9% and positive predictive value of 95.7%. They did the test over three sub groups and the sensitivity ranged 53.1% to 56% and Specificity range of 81.8% to 100%</p>
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Table 3. Summary of articles selected, results of sensitivity and specificity



### 7.3. Results of the selected articles

In the study for validity of hip provocation maneuvers to detect intra-articular hip pathology 50 subject were enrolled, 20 being men and 30 female. The average age was 60 year. For the purpose of this thesis the results of the clinical tests were reviewed. Each subject was examined with 4 different test to provoke the hip by physicians specialized in physical medicine and rehabilitation and interventional pain techniques. The four test were FABER, Stinchfield, Scour, and IROP.

FABER with sensitivity of  $21/26 = 0.82$  and a specificity of  $6/24 = 0.25$ .

Stinchfield with sensitive of  $15/26 = 0.58$  and specificity of  $7/24 = 0.29$ .

Scour with sensitivity of  $16/26 = 0.62$  and specificity of  $9/24 = 0.38$ .

IROP with sensitivity of  $23/26 = 0.88$  and specificity of  $4/24 = 0.17$ .

IROP and FABER test were concluded to be the highest of sensitivity 88% and 82%. Stinchfield was the highest for specificity with 38%. Considering these results IROP test is the most effective. The action of IROP is flexion internal rotation over pressure. (Maslowski, Sullivan, Forster, Harwood, Gonzalez, Kaufman & Akuthota 2010b)

The study done by Troelsen (2009) compared the sensitivity and specificity of Impingement test, FABER test, and resisted straight leg test. There were 18 subjects in the study. Impingement test found 10/18 giving it a sensitivity of 59% and specificity 100%; FABER test 7/18 sensitivity 41% and specificity 100%; Resisted straight leg test 1/18. All the test where confirmed with the use of ultrasound and MR Arthrography which has a sensitivity of 94% and specificity of 94%. They concluded that the most effective test is the impingement test for assessing hip labrum pain: flexion, internal rotation and adduction. (Troelsen, Mechlenburg, Gelineck, Bolvig, Jacobsen & Soballe 2009b)

The study by Hananouchi et. al (2012) they tested the accuracy of anterior impingement test when assessing for anterosuperior acetabular labral lesions and confirmed the results with the use of MRI. The study resulted an average of sensitivity 50.6%, specificity 88.9% and positive predictive value of 95.7%. They did the test over three

sub groups and the sensitivity ranged 53.1% to 56% and specificity range of 81.8% to 100% They surmised that though the sensitivity was low when detecting anterosuperior acetabular labral lesion it still had high positive predictive value making it useful when assessing labral lesions. (Hananouchi, Yasui, Yamamoto, Toritsuka & Ohzono 2012b)

When reviewing these three studies together there is a clear connection of the impingement test results. First study showed IROP (flexion internal rotation over pressure) sensitivity 82% Specificity 25%. The second study Impingement test (flexion internal rotation abduction) found 10 / 18 giving it a sensitivity of 59% and specificity 100% . The third study showed anterior impingement test (flexion internal rotation abduction) sensitivity with an average of 50.6% and specificity 81.8%

Between the three studies small changes were made when performing the impingement test. In the first it study they added over pressure, reaching across to the opposite hip and adding downward pressure. The second study added abduction and the third noted doing the test as originally described, adding no control for the the internal rotation. According to the reported sensitivity and specificity the review shows that impingement test, with the actions of flexion internal rotation abduction is the most effective test for hip labrum testing.

## 8. CONCLUSION

It was concluded from the review of the 3 articles that according to the reported sensitivity and specificity that impingement test; flexion, internal rotation, and adduction is the most effective test for assessing hip labrum pain.



Figure 4. Impingement test

(Troelsen, Mechlenburg, Gelineck, Bolvig, Jacobsen & Soballe 2009, Figure 1)

## 9. DISCUSSION

The topic for this thesis came about due to a few factors. I wanted to study something that interested me and would teach me something that would increase my abilities as a physiotherapist. Having done a 5 month work placement with Porin Ässät hockey club I was keen to learn more about treatments for hockey players. A discussion with the head physiotherapist from Porin Ässät expressed the interest in two possible topics: studies about concussion and hockey, and what is the best way to differentiate hip labrum pain from groin muscle pain.

Things became more difficult when trying to find studies with groin muscle pain, hip labrum, testing, and application to hockey. I soon discovered that the topic was too wide and I need to narrow it down. In the end the thesis was focused on the question what is the best hip labrum test. Since there are only a few studies devoted to testing hip labrum with hockey players, a more general view on testing the hip was adapted.

Though the result of the review showed flexion internal rotation abduction to be the most successful in assessing the hip labrum, it would be good to have a study that would look at subtle alterations to the test and on one subject group for a clear comparison. I also suspect that the test results are dependent on the testers ability to perform the test correctly.

A weakness in this review was the fact that the articles chosen were not assessed for quality. Also there were only 3 studies used in the review.

This thesis could be continued in a variety of ways. One could compile a list of the best tests for all condition of groin pain according to sensitivity and specificity. Referenced in chapter 3, a study had found adductor abdominal rectus dysfunction, and hip pathologic changes. It would be interesting to learn more about the changes and how they affect the players and possibly the testing methods. A deeper study could look at the exact biomechanics that effect the changes. (Silvis, Mosher, Smetana, Chinchilli, Flemming, Walker & Black 2011b)

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